Kentucky Method 64-626-08
Revised 043/0206/08
Supersedes 64-626-05
Dated 02/25/05

RESISTANCE OF CONCRETE TO FREEZE-THAW TESTING

1. SCOPE:

   1.1. This method covers the test to determine the resistivity of concrete specimens to rapidly repeated cycles of freezing in air and thawing in water in the laboratory.

   1.2. Follows ASTM C 666, Procedure B with exceptions and/or modifications. These are shown with the ASTM C 666 sections and paragraphs listed for reference.

2. APPARATUS: Subsection 4.4. Length change comparator accurately reading to the 0.0001 inch is required.

3. FREEZING AND THAWING CYCLE: Subsection 5.2. Freeze thaw cycle will be 3 hours ± 0.5 hour.

4. TEST SPECIMENS:

   4.1. Subsection 7.1. Prepare and cure test specimens in accordance with ASTM C 1921646 and ASTM C 490 and ASTM C 511 with the following exceptions:

      4.1.1 Coarse Aggregate shall be oven dried to a constant weight, then cooled to room temperature.

      4.1.2. Recombine to achieve a standard gradation. A standard gradation shall be determined by middle of the range percents retained for the appropriate size aggregate being tested. Produce enough material for either two beams for limestone mixes or three beams for gravel mixes. Mix Design outlined in Table 1 and Table 2.

      4.1.32. Batch weight of oven dried coarse aggregate shall be immersed in water approximately 24 hours prior to mix. Excess water is decanted over a #200 sieve to preserve fines. Then all + #200 material is placed in the mixer. Remember to use a larger sieve to protect the #200.

      4.1.43. Proportions concrete mixes for normal weight aggregate mixes as indicated in Tables 1 or 2 as appropriate.

      4.1.45. Proportions concrete mixes for lightweight aggregate to beas determined by the Central Materials Laboratory.

      4.1.56. Master Builder's Micro Air air entraining admixture shall be used in a quantity sufficient to achieve an acceptable air content.

4.1.~~6~~7. Method of consolidation shall be rodding.

4.1.~~7~~8. Two concrete beam test specimens shall be made and tested for limestone samples and three concrete beams shall be made and tested for gravel samples.

4.1.~~8~~9. Label the concrete beam specimens by scratching the sample id into the finished surface. This should be done before the concrete is fully set and avoid disturbing the underlying aggregate.

4.1.~~9~~10. Two concrete 4x8 cylinders shall be made and tested for compressive strength. Break one at 14 days and the other at 28 days.

4.1.1~~0~~1. Initial cure. Concrete beams shall be covered with a layer of wet cotton cloth and then with a layer of plastic to prevent rapid evaporation for the first 22 ± 2 hours.

~~4.1.12. Curing environment shall be immersion in water saturated with calcium hydroxide (hydrated lime).~~

4.2. Subsection 7.2. Specimens shall be 3 inches in depth, 4 inches in width, and 16 inches in length where the concrete beam shall have a gauge length of 14.75 inches. The gauge length is the innermost length between the gauge studs within a concrete beam.

5. PROCEDURE:

5.1. Subsection 8.1. Beam specimens for lightweight aggregate concrete applications where the concrete will not be exposed to moisture sufficient to approach critical saturation, as determined by the Engineer, shall be cured as follows: Beam specimens shall be immersed in water saturated with calcium hydroxide for a period of 14 days, allowed to air-dry for 14 days, then reimmersed for 24 hours in water prior to freeze thaw testing.

5.2. Subsection 8.3. Introduce new specimens to the testing chamber at the end of the thawing phase of the cycle. Allow temperature of the new specimens to reach 40 ± 3 degrees F for the zero cycle measurements by letting them sit in the circulating thaw water for one hour. Continue each specimen in the test until it has been subjected to a minimum of 350 cycles or until deterioration promotes removal.

6. CALCULATION: Subsection 9.3. When the 350 cycle count is exceeded, then interpolation of the percent expansion will be necessary. Calculation will be based on the cycle count immediately before and after the 350 cycle count is reached.

7. REPORT:

7.1. Subsection 10.2.3. Air content of fresh concrete conforming to Kentucky Method 64-303.

7.2. Subsection 10.2.4. Unit weight of fresh concrete is not required.

7.3. Subsection 10.2.5. Consistency (slump) of fresh concrete conforming to Kentucky Method 64-302.

7.4. Subsection 10.2.6. Air content of the hardened concrete is not required.

7.5. Subsection 10.5.1. Dimensions of specimens at zero cycles of freezing and thawing is not required.

7.6. Subsection 10.6.1. The durabilty factor shall be reported to the nearest whole number.

7.7. Subsection 10.6.2. Report the percentage of expansion to the nearest 0.01 percent.

7.8. Reports shall contain the following information:

7.8.1. Producer name

7.8.2. Date beam was cast

7.8.3. Ledge or Bench location

7.8.4. Start and ending date of test

7.8.5. Number of test cycles completed

7.8.6. Bi-weekly length, weight, and fundamental transverse readings

7.8.7 Durability factor

7.8.8 Percent expansion

7.8.9. Pass / Fail determination

APPROVED _____

DIRECTOR
DIVISION OF MATERIALS

DATE 043/0602/08

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TABLE 1

LIMESTONE SPECIMENS (2 BEAMS)		
	Size #57's, 67's, & 68's	Size # 8's, 9m's, & 78's
TYPE 1 CEMENT (lbs)	16.6	16.6
CONCRETE SAND (lbs)	35.2 x 1.0 + % moisture of sand in decimal. (Example: 3.4 % moisture) 35.2 x 1.034 = 36.4 lbs.	39.2 x 1.0 + % moisture of sand in decimal. (Example: 3.4 % moisture 39.2 x 1.034 = 40.5 lbs.
STONE (lbs)	54.6	50.7
AIR (%)	4 - 8 %	5 - 9 %
AIR ENTRAINMENT (ml)	5.0 ml (Adjust As Needed)	5.0 ml (Adjust As Needed)
SLUMP (in)	2 - 4 Inches	2 - 4 Inches
ESTIMATED WATER (lbs)	3.5 - 4.5 lbs. (Adjust As Needed)	3.5 - 4.5 lbs. (Adjust As Needed)

TABLE 2

GRAVEL SPECIMENS (3 BEAMS)		
	Size #57's, 67's, & 68's	Size # 8's, 9m's, & 78's
TYPE 1 CEMENT (lbs)	20.9	20.9
CONCRETE SAND (lbs)	44 x 1.0 + % moisture of sand in decimal. (Example: 3.4 % moisture) 44 x 1.034 = 45.5 lbs.	49 x 1.0 + % moisture of sand in decimal. (Example: 3.4 % moisture 49 x 1.034 = 50.7 lbs.
STONE (lbs)	60.5	57.4
AIR (%)	4 - 8 %	5 - 9 %
AIR ENTRAINMENT (ml)	5.5 ml (Adjust As Needed)	5.5 ml (Adjust As Needed)
SLUMP (in)	2 - 4 Inches	2 - 4 Inches
ESTIMATED WATER (lbs)	3 - 4 lbs. (Adjust As Needed)	3 - 4 lbs. (Adjust As Needed)